

# 12 Principles of Multimedia Design

## *An Open Educational Resource*

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## CHAPTER 1: INTRODUCTION

### Multimedia Design

Multimedia is the convergence of different media modalities such as text, audio, video, animation, and images, and the process by which the computer uses these media to communicate to its users (Bangia, R., 2015). The use of multimedia offers great advantages in various fields such as education, entertainment, and broadcasting, as multimedia enhances the overall design and the effectiveness of information dissemination.

#### Media Modalities:

Text, Audio, Video,  
Animation, Graphics

Similarly, multimedia design is the art of integrating these media in designing digital materials to communicate a message. Additionally, interactive elements play a crucial role in creating appealing material—interactivity enhances viewer engagement and improves user experience.

### 12 Principles of Multimedia Design



Retrieved from:  
<https://www1.udel.edu/PR/UDaily/2008/jul/multimedia071107.html>

According to educational psychologist Richard Mayer in his book *Multimedia Learning* (Second Edition), there are 12 principles of Multimedia Design that enhance student learning and retention. These principles are composed of five (5) principles for reducing extraneous processing, three (3) principles for managing essential processing and Four (4) principles for fostering generative processing.

Multimedia design principles help educators and multimedia designers in crafting educational content that will get students engaged and enhance the learning process.

**Learn More** | Supplementary Video Lesson

**“12 Multimedia Instructional Principles”** by Mike Tyler:  
[https://youtu.be/R6yUsUkePVI?si=OcVdRMtu0KB9BD\\_0](https://youtu.be/R6yUsUkePVI?si=OcVdRMtu0KB9BD_0)

## CHAPTER 2: 12 PRINCIPLES OF MULTIMEDIA DESIGN

### Extraneous Processing

Have you ever experienced encountering overloaded presentation slides, unnecessary animations and images in a material, or even being distracted by loud noises while studying? —These scenarios make your brain work more than it usually does just to focus—a reason for cognitive overload or extraneous processing.

“Extraneous processing is cognitive processing during learning that does not serve the instructional goal – such as attending to irrelevant information or trying to make up for confusing layout of the lesson.”—Richard Mayer.

### 5 Principles for Reducing Extraneous Processing

Richard Mayer outlined five principles to avoid and reduce extraneous processing; these concepts help learners to improve cognitive skills such as focus and understanding. These principles also serve as a guide to multimedia designers to eliminate unnecessary elements and deliver the message in a more effective way.

#### Coherence Principle

Effective learning happens when unnecessary or extraneous elements and materials (words, sounds, or visuals) are excluded from the material. Irrelevant information can lead to distraction and information overload that promotes boredom and mental weariness.

The coherence principle is divided into three versions:

1. Learning is improved when interesting but irrelevant words and pictures are excluded from a multimedia presentation.
2. Learning is improved when interesting but irrelevant sounds and music are excluded from a multimedia presentation.
3. Learning is improved when unneeded words and symbols are eliminated from a multimedia presentation.

Coherence principle highlights the value of excluding extraneous elements that does not help to achieve the learning objectives.

*Focus on what's important and eliminate what doesn't*

Example: A teacher prepared a PowerPoint presentation to discuss the geological time scale. He included clear timelines, concise labels, bullet points, and key events to explain each era without using long paragraphs of text and unrelated images and videos. In return, students enjoyed the discussion and retained valuable information from the presentation.

**Learn More |** Supplementary Video Lesson

**“Coherence Principle | The 12 Multimedia Instructional Principles”**

by Mike Tyler: [https://youtu.be/6TResG7fyCk?si=P-b1B1\\_4qGvQQ7eV](https://youtu.be/6TResG7fyCk?si=P-b1B1_4qGvQQ7eV)

## Signaling Principle

This principle emphasizes the importance of cues that highlight the important information found in the learning material. **Arrows, bold texts, italics, highlights, etc.,** serve as cues that guide learners to focus on certain sections that are critical for understanding the lesson. These signs make the material organized and easy to navigate, en route to a better understanding of the material.

**Verbal Signaling:** The use of words and phrases to transmit information.

**Visual Signaling:** The use of visual cues to convey information.

Verbal Signaling	Visual Signaling
Outline	Arrows
Headings	Distinctive Colors
Vocal Emphasis	Flashing
Pointer Words	Pointing Gestures
	Graying out

Example: In an animation that explains the parts of a cell, arrows are used to point out each organelle that is being discussed by the narrator.

**Learn More** | Supplementary Video Lesson

**“Signalling Principle | The 12 Multimedia Instructional Principles”**

by Mike Tyler: <https://youtu.be/U-H7-iSJU-E?si=4zivD8e2wYdtgzbX>

## Redundancy Principle

Learning is enhanced when two or mediums are used (i.e., spoken words and graphics). Redundancy Principle tells us to avoid unnecessary duplication of information of the same format—redundancy creates extraneous processing.

*Do not present the same information at the same time using different formants.*

Example: When presenting a lesson, the instructor may use graphical elements to complement his spoken explanation of the lesson, rather than flashing out a text-based presentation with the exact same words.

**Learn More** | Supplementary Video Lesson

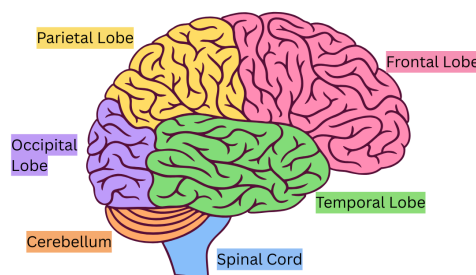
**“Redundancy Principle | The 12 Multimedia Instructional Principles”**

by Mike Tyler: <https://youtu.be/cAt5o-VI1yA?si=TLH3CT5Uug9MgNe8>

Note: This OER includes both a brief explanation and a supplementary (optional) video lesson. This approach is not redundant, as no information/content are being presented repeatedly. This practice provides deeper understanding and the flexibility to choose the medium that best suits their learning styles.

## Spatial Contiguity Principle

Text and visuals should be placed in close proximity to make connections more easy to understand—like labeling each bone on an image of the skeletal system. Avoid separating the text from its corresponding visual element.



The figure applies the Spatial Contiguity Principle by placing the labels (text) next to their corresponding parts of the brain in the image.

Example: The instructor tasked his students with memorizing the hardware components of a computer. He provided a module that shows each hardware component along with its name beside it, rather than just showing the images alone.

**Learn More** | Supplementary Video Lesson

**“Spatial Contiguity Principle | The 12 Multimedia Instructional Principles”**  
by Mike Tyler: [https://youtu.be/W-uGF3ys\\_aE?si=7SW6VZEzpeUrwjhl](https://youtu.be/W-uGF3ys_aE?si=7SW6VZEzpeUrwjhl)

### Temporal Contiguity Principle

This principle suggests that students build mental connection between verbal and visual representations when words and pictures are presented simultaneously rather than successively. This principle is related to Spatial Contiguity Principle as they both improve cognitive processing and reduce extraneous mental effort.

Spatial Contiguity Principle	Temporal Contiguity Principle
Place the words next to its corresponding image/visual element	Present words/narration and visual elements at the same time (simultaneously)

Example: Julia planned to upload a makeup tutorial on her YouTube channel. While narrating, she explained each step as she simultaneously showed the product and demonstrated how to use it.

**Learn More** | Supplementary Video Lesson

**“Temporal Contiguity Principle | The 12 Multimedia Instructional Principles”**  
by Mike Tyler: <https://youtu.be/tx-3gKKTqa4?si=8jJusLkrJMKBvn8p>

## Essential Processing

Essential processing is the cognitive effort needed to hold and grasp important information in [working memory](#) during learning. It is the minimum mental effort to create a cognitive representation of the learning material, not the act of making meaning of the knowledge.

“Essential processing is cognitive processing aimed at mentally representing the essential material in working memory.”—Richard Mayer.

### 3 Principles for Managing Essential Processing

There are three ways to reduce mental overload and enhance essential processing according to Cognitive Theory of Multimedia Learning (CTML) by Richard Mayer. These principles help students to focus, organize and retain information from the multimedia material.

#### Segmenting Principle

This principle promotes learner-paced material that allows students to navigate the educational material through smaller fragments or sections rather than presenting the information all at once. This practice helps the students to grasp the material one step at a time, making knowledge acquisition more effective.

Example: A science teacher designed an educational website about the timeline of human evolution; he created sections that divide the lesson into several chunks. Additionally, he included “Next” and “Back” buttons to allow the students to explore the website at their own pace.

**Learn More |** Supplementary Video Lesson

**“Segmenting Principle | The 12 Multimedia Instructional Principles”**  
by Mike Tyler: <https://youtu.be/KxxK-kRs6Cw?si=Qm-YM7p2xdDKPGmx>

#### Pre-Training Principle

Pre-training exposes the learners to the essential concepts and vocabulary of the lesson before the actual discussion or presentation. This will provide an introductory overview of the material, making it easier for students to understand the learning objectives. Familiarity with the material is key to retention.

Example: Before discussing the different energy systems used by the body, the instructor conducted a multimedia icebreaker activity to introduce the fundamentals of the lesson. Key terms such as “aerobic,” “anaerobic,” and “adenosine triphosphate,” along with brief explanations, were displayed on the screen as preparation for the actual discussion the following day.

**Learn More** | Supplementary Video Lesson

**“Pre-Training Principle | The 12 Multimedia Instructional Principles”**

by Mike Tyler: <https://youtu.be/NWZcRDKS6SY?si=97iMS09G9vvsonmi>

## Modality Principle

This principle states that modality plays a crucial role in the effectiveness of learning materials. Learners retain information better when both the visual and auditory channels are used. Presenting information through pictures and spoken words is more effective than using pictures and printed text, as it helps reduce cognitive overload and improves understanding.

Example: A physics teacher prepared a video discussion about the laws of thermodynamics. While an animation is playing, he narrates the process rather than just flashing out the text on the screen.

**Learn More** | Supplementary Video Lesson

**“Modality Principle | The 12 Multimedia Instructional Principles”**

by Mike Tyler: <https://youtu.be/mo6PdP0emQs?si=B-ddkkyR4og7egrS>

## Generative Processing

Essential processing deals with the cognitive process to hold the provided information, while generative processing refers to the mental effort to make sense of the material. It's also about the organization of the material into coherent structures and connecting it with other existing knowledge.

“Generative processing is cognitive processing aimed at making sense of the material and includes organizing the incoming material into coherent structures and integrating these structures with each other and with prior knowledge..”—Richard Mayer.

## 4 Principles for Fostering Generative Processing

Generative processing is crucial for knowledge acquisition and utmost retention of the material which is the goal of multimedia learning. In order to achieve generative processing, Mayer presented four principles that support deeper understanding, active learning and connection between new and prior knowledge.

### Multimedia Principle

People learn better from words and pictures than from words alone. The use of image and text engages both the verbal and visual channels of the brain, leading to a more effective learning process.

Example:



Multimedia Principle

#### GRAPHIC CARD

Gigabyte GeForce RTX 3050 WINDFORCE OC 6G Graphics Card - GV-N3050WF2OC-6GD

The graphics card works with the central processing unit (CPU) to process and output visual data. It accelerates the graphics processing capabilities of your computer, enabling you to enjoy smooth and high-quality visuals in games, videos, and other graphic-intensive applications. GeForce RTX 3050 is a good choice for 1080p Full HD gaming at highest settings. There are a few titles in our games list that don't hit 60 FPS, sacrificing a few details settings here will get you over 60 easily though.

Text Only

**Learn More |** Supplementary Video Lesson

**“Multimedia Principle | The 12 Multimedia Instructional Principles”**

by Mike Tyler: [https://youtu.be/\\_vOhXCHiJek?si=HofjActr6M5HjqUM](https://youtu.be/_vOhXCHiJek?si=HofjActr6M5HjqUM)

## Personalization Principle

The tone of the material also contributes to its effectiveness. Use a conversational tone rather than a formal, robotic one. To make the tone more conversational, multimedia instructional designers may talk directly to the readers with the use of “you” or “we,” use simple sentence structures, and use everyday language.

Example: A professor found an OER (CC BY-NC-SA) that fit with his lesson. However, he realized the tone of the material is too formal that’s why he edited it to make the tone more conversational:

Original text: The learners are tasked to understand the lessons from this module and answer the guide questions.

Edited text: You’ll go through the lessons in this module and then answer some guide questions to check your understanding.

**Learn More |** Supplementary Video Lesson

**“Personalization Principle | The 12 Multimedia Instructional Principles”**

by Mike Tyler: <https://youtu.be/DYyKA42Qq2o?si=NwfQOivnGiADcqY3>

## Voice Principle

Have you tried listening to AI-generated audio? It feels like a robot is talking to you. Voice principle states that people prefer listening to audio discussion (i.e., animation, presentation, podcast, etc.) with a friendly human voice rather than by a machine voice. This is because a human voice can make learners feel more connected and supported as they go through the material.

Try listening to these two YouTube tutorials on how to use software that generates AI audio voices. Compare the audio in each video and reflect on which one sounds better.

[1] How To Make AI Voice Sound Realistic using Audacity - realistic ai voice generator: <https://youtu.be/CInNhePBCZk?si=yy5Aj5ob1s7eh2hf>

[2] 4 Elevenlabs Voice Tips in 3 Minutes (add pauses, emotions & dubbing) <https://youtu.be/LUmjBtINiYs?si=bRvMSIY9NOT34qDO>

*If you notice, the first video sounds more robotic and doesn't feel as natural compared to the second one, where a real person is narrating the tutorial.*

Example: Instead of using AI tools to generate the audio, the instructor recorded his own voice while narrating the script to create a more personal connection with the learners.

**Learn More |** Supplementary Video Lesson

**“Voice Principle | The 12 Multimedia Instructional Principles”**

by Mike Tyler: [https://youtu.be/ysHfnB\\_ySQ?si=aswOdzqAGxYHYAbK](https://youtu.be/ysHfnB_ySQ?si=aswOdzqAGxYHYAbK)

## Image Principle

The last principle states that learners don't necessarily understand the material better from seeing the speaker's face on screen. The instructor not being seen by the learners does not affect the learning process; thus, instead of utilizing a talking head for presentation, use images and graphics that best complement the material for enhanced learning.

Example: Have you ever watched [The Organic Chemistry Tutor](#)? Learners can't see the instructor's face because the video focuses on the lesson itself. Showing the instructor's talking head might only distract them from retaining the important information.

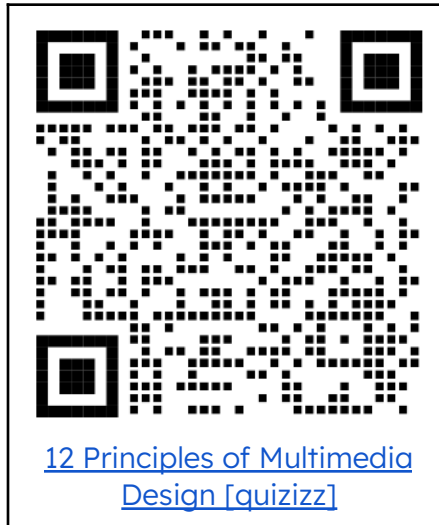
**Learn More |** Supplementary Video Lesson

**“Image Principle | The 12 Multimedia Instructional Principles”**

by Mike Tyler: <https://youtu.be/GxkdaRbkx6o?si=HEWMmGeDw1XzehDt>

## Chapter 3: Knowledge Check

To check your understanding, take this short quiz on the 12 Principles of Multimedia Design. You can try as many times as you like until you're happy with your score.



If ever the link gets corrupted or expires, you may access the quiz through this Google Drive link:

[https://drive.google.com/file/d/1\\_ZCb2yURXL13VLI0uIQk9YWTZWkBb\\_2k/view?usp=sharing](https://drive.google.com/file/d/1_ZCb2yURXL13VLI0uIQk9YWTZWkBb_2k/view?usp=sharing)

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